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10/519,073	12/23/2004	Atsushi Fukui	MAM-056	7337

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EXAMINER
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LEE, CYNTHIA K

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 11/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/519,073

Applicant(s)

FUKUI ET AL.

Examiner

Cynthia Lee

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 2-8, 11, 13-15, 17 and 20-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-8, 11, 13-15, 17 and 20-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 November 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_.

### ***Response to Arguments***

This Office Action is responsive to the amendment filed on 10/11/2006. Claims 2-8, 11, 13-15, 17, and 20-22 are pending. Applicant's arguments have been considered and are persuasive. Thus, claims 2-8, 11, 13-15, 17, and 20-22 are rejected for reasons stated herein below.

### ***Specification***

The disclosure is objected to because of the following informalities:

It is unclear how the binder  $\alpha 1$  differs from binder  $\beta 1$  since both binders are produced by the same procedure of Experiment 1 and in both binders used polyamic acid and heat treated to produce polyimide from polyamic acid and the polyamide content, by weight, in the active material layer was 18.2% (refer to pgs. 19 and 30).

Applicant argues that a person of ordinary skill in the art would understand that the use of different polyamic acids is required to obtain binders having different properties if the same conditions are used. The Examiner notes that the Applicants have not disclosed what the different polyamic acids are.

Further, it is unclear how binder  $\alpha 2$  differs from  $\alpha 3$  (pg 30 of specification).

Appropriate correction is required.

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140

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F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 2-8, 11, 13-15, 17, 20-22 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-4, 6-9, 12, 19, 21, 24, 41, and 75-77 of copending Application No. 10/363039. Although the conflicting claims are not identical, they are not patentably distinct from each other. Both sets of claims claim a negative electrode comprising active material particles containing silicon and/or silicon alloy, a binder on a current collector with a specific surface roughness of the current collector. Although the instant claims do not recite the diffusion of particles, it is noted that a copper metal foil would meet this limitation, as disclosed by the copending specification (pg. 8, lines 1-10). Although the copending claims do not expressly recite the mechanical properties of a current collector and a binder as claimed in the instant application, it is deemed to have been met by a process in which a surface roughened copper foil current collector and the binder are sintered below the decomposition temperature and above the glass transition temperature of the binder.

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This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claims 2-8, 11, 13-15, 17, 20-22 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-4, 6-9, 12, 19, 21, 24, 41, and 75-77 of copending Application No. 10/673348. Although the conflicting claims are not identical, they are not patentably distinct from each other. Both sets of claims claim a negative electrode comprising active material particles containing silicon and/or silicon alloy, a binder on a current collector with a specific surface roughness of the current collector. Although the instant claims are not claiming a slurry, the specification discloses and thus enables one of ordinary skill in the art to mix the binder, conductive material, and active material to form a slurry.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claims 2-8, 11, 13-15, 17, 20-22 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-15 of copending Application No. 11/001192. Although the conflicting claims are not identical, they are not patentably distinct from each other. Both sets of claims claim a negative electrode comprising active material particles containing silicon and/or silicon alloy, a binder on a current collector with a specific surface roughness of the current collector. The electrode assembly in the instant application is a flat cell and is

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not spirally rolled. However, spirally shaped batteries are common in the art and it would have been obvious to one of ordinary skill in the art at the time the invention was made to make a flat cell a spiral battery for the benefit of increasing the capacity of the cell by being able to roll the active material layer, versus a single flat layer. Further, the specification of the instant application discloses and enables one of ordinary skill in the art to make a negative electrode active material thickness of between 10 and 1000 micrometers of the cell [0030]. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists, see MPEP 2144.05. Further, it has been held by the courts that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et. al., 33 CCPA 1250, 156 F.2d 239, 70 USPQ 412.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 2-8, 11, 13-15, 17, 20-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to

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make and/or use the invention. The specification does not disclose as to what are the different polyamic acids that were used to prepare polyimide for binders  $\alpha 1$  and  $\beta 1$ .

Also, the specification does not disclose how thermoplastic polyimide of  $\alpha 2$  differs from  $\alpha 3$ .

It appears that the amount of direction, the number of working examples, and the breadth of claims are not commensurate in scope with the disclosure as originally filed. Hence undue experimentation would be required to determine what the different polyamic acids or thermoplastic polyimide are used to make the invention as claimed.

With respect to enablement commensurate in scope with the claims, section 2164.08 of the MPEP states:

"The Federal Circuit has repeatedly held that 'the specification must teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation'. In re Wright, 999 F.2d 1557, 1561, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993)... The determination of the propriety of a rejection based upon the scope of a claim relative to the scope of the enablement involves two stages of inquiry. The first is to determine how broad the claim is with respect to the disclosure. The entire claim must be considered. The second inquiry is to determine if one skilled in the art is enabled to make and use the entire scope of the claimed invention without undue experimentation."

Factors to be considered when determining whether the claimed invention would require undue experimentation are given in MPEP 2164.01 (a). In re Wands, 858 F. 2d

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731, 737; 8 USPQ 2d 1400, 1404 (Fed. Cir. 1988). Only the relevant factors will be addressed for determining undue experimentation of the presently claimed invention. The relevant factors are (A) the breadth of the claims; (B) the amount of direction provided by the inventor; (C) the existence of working examples, (D) the level of predictability in the art; and (E) the quantity of experimentation needed to make or used the invention based on the content of the disclosure.

**Factor (A) Breadth of the claims:**

Claim 2 claims the mechanical properties of a binder. Specification pgs 18 and 19 state that binder  $\alpha$ 1 was produced by the heat treatment of polyamic acid from mixing 8.6 wt% N-methylpyrrolidone solution containing 19.8 parts by weight of polyamic acid. Pg 30 states that binder  $\beta$ 1 was made by polyamic acid.

Applicant asserts that polyamic acid used in  $\alpha$ 1 and  $\beta$ 1 were different polyamic acids (pg 9 of Remarks). Applicant has not disclosed the different polyamic acids used to make this invention. Further, no guidance is given to direct one in the art to the different polyamic acids to make the binders to arrive at the mechanical properties as claimed by the Applicants. Further, Applicants have not disclosed how thermoplastic polyimide of binder  $\alpha$ 2 differs from polyimide of binder  $\alpha$ 3.

**Factor (B) The amount of direction provided by the inventor.**

Applicant has not disclosed the different polyamic acids used to make this invention. Further, no guidance is given to direct one in the art to the different polyamic



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acids to make the binders to arrive at the mechanical properties as claimed by the Applicants.

**Factor (C) The existence of working examples:**

No working example is given to direct one in the art to the different polyamic acids to make the binders to arrive at the mechanical properties as claimed by the Applicants.

**Factor (D) The level of predictability in the art:**

It appears that different mechanical properties are achieved by using different forms of polyamic acid. Thus, there is a level of unpredictability in the art with respect to obtaining a binder with certain types of mechanical properties.

With respect to the relationship of predictability of the art and the enablement requirement, MPEP 2164.03 states:

“The amount of guidance or direction needed to enable the invention is inversely related to the amount of knowledge in the state of the art as well as the predictability in the art. In re Fisher, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970). The “amount of guidance or direction” refers to that information in the application, as originally filed, that teaches exactly how to make or use the invention. The more that is known in the prior art about the nature of the invention, how to make, and how to use the invention, and the more predictable the art is, the less information needs to be explicitly stated in the specification. In contrast, if little is known in the prior art about the nature of the invention and the art is unpredictable, the specification would need more detail as to how to make and use the

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invention in order to be enabling. >See, e.g., Chiron Corp. v. Genentech Inc., 363 F.3d 1247, 1254, 70 USPQ2d 1321, 1326 (Fed. Cir. 2004)... The "predictability or lack thereof" in the art refers to the ability of one skilled in the art to extrapolate the disclosed or known results to the claimed invention. If one skilled in the art can readily anticipate the effect of a change within the subject matter to which the claimed invention pertains, then there is predictability in the art. On the other hand, if one skilled in the art cannot readily anticipate the effect of a change within the subject matter to which that claimed invention pertains, then there is lack of predictability in the art. Accordingly, what is known in the art provides evidence as to the question of predictability... However, in applications directed to inventions in arts where the results are unpredictable, the disclosure of a single species usually does not provide an adequate basis to support generic claims. In re Soll, 97 F.2d 623, 624, 38 USPQ 189, 191 (CCPA 1938). In cases involving unpredictable factors, such as most chemical reactions and physiological activity, more may be required. In re Fisher, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970)[emphasis added]."

**Factor (E) the quantity of experimentation needed to make or used the invention based on the content of the disclosure.**

This factor has been addressed by factors (A)-(C) above.

Thus, the claims are properly rejected for scope of enablement since the two stages of inquiry as set forth in MPEP section 2164.08 have been fully addressed herein by the Examiner.

***Claims Analysis***

The limitation "the current collector is subject to heat treatment before the active material layer is provided on the surface of the current collector" was considered, but

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was not given patentable weight because the courts have held that the method of forming the product is not germane to the issue of patentability of the product itself. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.

Applicant argues that heat treatment of a metallic foil can cause structural changes. However, the Examiner notes that the heat treatment of the current collector prior to providing the active material layer is solely for the purposes of analyzing the properties of the current collector without the presence of the active material layer. The Specification pg 5 line 23 states that “[i]t is difficult to measure mechanical properties of the current collector after the sintering treatment, because it then carries the active material layer thereon to constitute the negative electrode. Instead, the current collector before the sintering treatment can be separately subjected to the same heat treatment as the sintering treatment and then measured to determine such mechanical properties.”

The Examiner acknowledges that sintering imparts structural changes. However, the process in which “the current collector is subject to heat treatment before the active material layer is provided on the surface of the current collector” is not part of the manufacturing process. It is an analytical technique to measure the mechanical properties of the current collector.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-8, 11, 13-15, 20-22 are rejected under 35 U.S.C. 103(a) as obvious over Nobufumi (JP 2000-012088) in view of Tsuji (US 6432579) and Solomon (US 4927514).

Nobufumi discloses a negative electrode and a rechargeable lithium battery comprising a mixture of silicon-containing anode material, carbon material, and a binder. The mixture is prepared and a base material made of a foil or mesh of conductive metal is coated with the mixture to form a coated film. The coated film is sintered in a non-oxidizing atmosphere, thereby integrating a sintered material of the coated film with the base material. Nobufumi discloses that the base material is a electrolytic copper foil. The rechargeable lithium battery includes a positive electrode material and a nonaqueous electrolyte. The particle size of the silicon-containing compounds is from 0.01 um to 100 um. (See abstract, [0005, 0007, 0011, 0020, 0032-39, 0058-0061]) Nobufumi discloses that the conductive metal foil thickness is between 3 and 100 um. The current collector has a roughness of 0.03 to 1 um. Nobufumi discloses that the thickness of the anode active material is between 10-1000 um and depends on the magnitude of the cell [0040]. Further, the binder used is polyvinylidene fluoride. The glass transition temperature is 30 C and the melting temperature is 158 C (see reference attached).

In Example 28, the surface roughness of the current collector is 1 um [0066]. The thickness of the active material and current collector are the same as that of Example 1. The thickness of the active material is 30 um. The thickness of the current

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collector is 20  $\mu\text{m}$  [0061]. Nobufumi meets the range  $5Y \geq X$  and  $250Ra \geq X$  as claimed by the applicants in which X is the thickness of the active material layer, Y is the thickness of the current collector, and Ra is the surface roughness of the current collector.

Nobufumi does not disclose sintering at a temperature higher than a glass transition temperature of the binder (claim 2) and lower than the decomposition temperature of the binder (claim 11). Nobufumi does not disclose the mechanical properties as claimed in claim 2. The properties recited in claim 2 are deemed to have been met by a process in which a surface roughened copper foil current collector and the binder are sintered below the decomposition temperature and above the melting temperature of the binder.

However, Tsuji teaches of forming a paste of silicon particles with carbon black and a binder and coating the paste onto a foil or mesh of conductive metal (applicant's current collector) and sintering the coated film in a non-oxidizing atmosphere, thereby integrating a sintered material of the coated film with the base material (2:30-53). By sintering a silicon-containing coated film and a base material made of conductive metal in a non-oxidizing atmosphere, the contact area of interface between a sintered material and a current collector are increased, and the sintered material is integrated with the current collector, thereby making it possible to reduce the contact resistance between the sintered material and the current collector and to provide an anode of a thin film whose conductivity has been improved (2:30-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to sinter Nobufumi's negative

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electrode for the benefit of improving the conductivity of the electrode, as Taught by Tsuji.

Nobufumi as modified by Tsuji do not teach that sintering is carried out at a temperature sintered below the decomposition temperature and above the melting temperature of the binder. This leads to a final product that does not cause full decomposition of a binder. Tsuji teaches that when using copper as the base material, the sintering is carried out at a temperature range of 500 to 900 C (4:50-55), but does not expressly teach that the binder is present in the final product. However, Solomon teaches an electrode in which an active material mixture is deposited onto the support layer. The resulting layer is then sintered to provide an electrode structure consisting of a support layer and an active layer. Typically, this sintering is conducted at a temperature sufficiently low to not cause any deleterious polymer decomposition, e.g., when PTFE is present in both the support layer and the active layer, heating can be at a temperature within the range of from about 280 C to 350 C. Generally, sintering temperatures will not exceed above about 350 C. It would have been obvious to one of ordinary skill in the art at the time the invention was made to sinter Nobufumi's negative electrode as modified by Tsuji and Solomon, in a temperature range that does not cause deleterious polymer decomposition.

The combination of Nobufumi, Tsuji, and Solomon would result in active material particles sintered below the decomposition temperature and above the melting temperature of the binder.

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Claim 17 is rejected under 35 U.S.C. 103(a) as obvious over Nobufumi (JP 2000-012088) in view of Tsuji (US 6432579) and Solomon (US 4927514) as applied to claim 2, further in view of Gan (US 2002/0094480).

The combination of Nobufumi, Tsuji, and Solomon teaches that the binder is a polyvinylidene fluoride and does not teach that the binder is a polyimide. However, Gan teaches of an electrode with a binder material which is preferably a fluoro-resin powder such as polytetrafluoroethylene (PTFE), polyvinylidene fluoride (PVDF), polyethylenetetrafluoroethylene (ETFE), polyamides, polyimides [0015]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute Nobufumi's polyvinylidene fluoride for Gao's polyimide because it has been held by the court that the selection of a known material based on its suitability for its intended use is *prima facie* obvious. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See MPEP 2144.07.

### ***Response to Arguments***

Applicant's prior art arguments filed 10/11/2006 have been considered but are moot in view of the new ground(s) of rejection.

*Applicant argues that the glass transition temperature of polyvinylidene fluoride is -38 C and not 30 C.*

The Examiner notes that the source supporting that the glass transition temperature of polyvinylidene fluoride of -38 C can be unreliable, misleading, out-of-date or just plain wrong (see the bottom of the printout provided by the Applicants).

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Applicants are advised to provide a more reliable source to support this assertion. In any event, both 30 C and -38 C are below 450 C.

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cynthia Lee whose telephone number is 571-272-8699. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ckl

Cynthia Lee

Patent Examiner

  
SUSY TSANG-FOSTER  
PRIMARY EXAMINER